(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 147 978 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.10.2001 Bulletin 2001/43

(51) Int Cl.[7]: **B62M 9/12**

(21) Application number: **01108859.8**

(22) Date of filing: **09.04.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **17.04.2000 US 550712**

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(54) Bicycle derailleur

(57) A derailleur 12 for a bicycle 10 is provided that is easy to operate. The derailleur 12 basically has a mounting member 40, a chain guide 42 and a chain guide positioning mechanism 48. The mounting member 40 is adapted to be coupled to a portion of the bicycle 10. The chain guide 42 is movably coupled to the mounting member 40. The chain guide 42 is adapted to shift a chain 20 of a bicycle 10 in a transverse direction. The chain guide positioning mechanism 48 has an actuating cam 71 operatively coupled to the chain guide 42. The actuating cam 71 is adapted to be coupled to a control element 18 such as a cable. The actuating cam 71 is arranged to rotate only in one direction in response to movement of the control element 18 to move the chain guide 42 from a first position to a second position. In the preferred embodiment, the chain guide positioning mechanism 48 includes one-way clutch coupled to the actuating cam 71, and an indexing mechanism 74 with an indexing element 90 that is arranged to operatively apply a retaining force to the actuating cam 71. The one-way clutch has a ratchet 70 fixedly coupled to the actuating cam 71 and an actuating element 80 with a pawl 81 engaging the ratchet 70. The actuating element 80 is adapted to be coupled to the control element 18 such that the control element 18 rotates the actuating element 80, which in turn engages the ratchet 70 to rotate the actuating cam 71 and moves the chain guide 42.

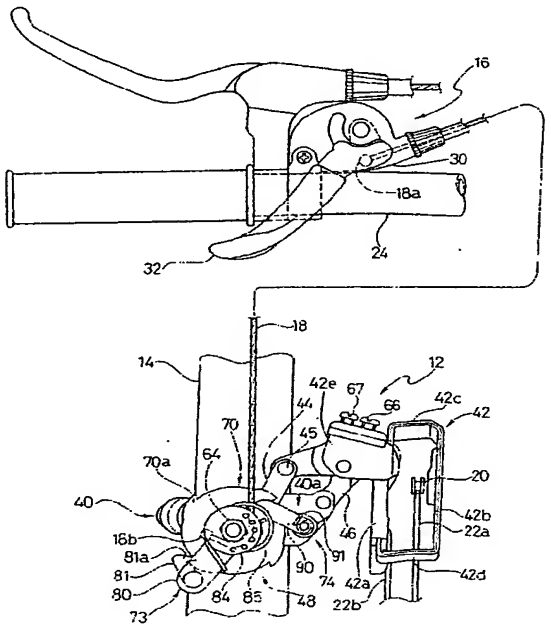

FIG. 2

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guide positioning mechanism when a control cable is pulled to shift the derailleur from the top position to a low position;

Figure 8 is a schematic elevational view of the front derailleur illustrated in Figures 5-7 showing the chain guide positioning mechanism in a fully actuated position after the derailleur is shifted from the top position into the low position;

Figure 9 is a schematic elevational view of the front derailleur illustrated in Figures 8 with portions of the chain guide positioning mechanism broken away to show the positions of the actuating cam and cam follower when the derailleur is in the low position;

Figure 10 is a schematic elevational view of the front derailleur illustrated in Figures 5-9 showing the actuating member in an intermediate position during release of the control cable after shifting the derailleur from the top position into the low position;

Figure 11 is a schematic elevational view of the front derailleur illustrated in Figures 5-10, showing the actuating member completely returned to the release or rest position after the derailleur is shifted from the top position into the low position;

Figure 12 is a schematic elevational view of the front derailleur illustrated in Figures 5-11 showing an intermediate position of the front derailleur and chain guide positioning mechanism when a control cable is pulled to shift the derailleur from the low position to the top position;

Figure 13 is a schematic elevational view of the front derailleur illustrated in Figures 5-12 showing the chain guide positioning mechanism in a fully actuated position after the derailleur is shifted from the low position into the top position;

Figure 14 is a schematic elevational view of the front derailleur illustrated in Figure 13 with portions of the chain guide positioning mechanism broken away to show the positions of the actuating cam and cam follower when the derailleur is returned to the top position;

Figure 15 is a schematic elevational view of the front derailleur illustrated in Figures 5-14 showing the actuating member in an intermediate position during release of the control cable after shifting the derailleur from the low position into the top position;

Figure 16 is an enlarged top plan view of a portion of the housing of the front derailleur illustrated in Figures 1-15;

Figure 17 is a front elevational view of the portion of the housing illustrated in Figure 15;

Figure 18 is a rear elevational view of the portion of the housing illustrated in Figures 16 and 17;

Figure 19 is an enlarged side elevational view of a main axle of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 20 is an end elevational view of the main axle illustrated in Figure 19;

Figure 21 is an enlarged side elevational view of an inner link axle of the front derailleur illustrated in Figures 1-15;

Figure 22 is an end elevational view of the inner link axle illustrated in Figure 21;

Figure 23 is an enlarged left side elevational view of an indexing axle of the front derailleur illustrated in Figures 1-15;

Figure 24 is a front elevational view of the indexing axle illustrated in Figure 23;

Figure 25 is a right side elevational view of the indexing axle illustrated in Figures 23 and 24;

Figure 26 is an enlarged side elevational view of an inner link of the front derailleur illustrated in Figures 1-15;

Figure 27 is an end elevational view of the inner link illustrated in Figure 26;

Figure 28 is an enlarged side elevational view of an inner link rivet of the front derailleur illustrated in Figures 1-15;

Figure 29 is an enlarged side elevational view of the cam follower with a roller of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 30 is an enlarged front elevational view of a positioning ratchet of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 31 is an end elevational view of the positioning ratchet illustrated in Figure 30;

Figure 32 is a rear elevational view of the positioning ratchet illustrated in Figures 30 and 31;

Figure 33 is a cross-sectional view of the positioning ratchet illustrated in Figures 30-32 as seen along section line 33-33 of Figure 30;

Figure 34 is an enlarged front elevational view of the actuating member of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 35 is a right side elevational view of the actuating member illustrated in Figure 34;

Figure 36 is a left side elevational view of the actuating member illustrated in Figures 34 and 35;

Figure 37 is a cross-sectional view of the actuating member illustrated in Figures 34-36, as seen along section line 37-37 of Figure 35;

Figure 38 is an enlarged side elevational view of a fixing plate of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 39 is an enlarged side elevational view of a pawl axle of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

Figure 40 is an end elevational view of the pawl axle illustrated in Figure 39;

Figure 41 is an enlarged side elevational view of an indexing arm of the chain guide positioning mechanism of the front derailleur illustrated in Figures 1-15;

40b are pivotally coupled together by the pivot pin 40c, which extends in a substantially vertical direction relative to the bicycle 10. The other ends of the clamping portions 40a and 40b are releasably connected together by the fastener 40d. The fastener 40d is preferably a screw or fixing bolt that is threaded into a threaded hole of the second end of the first clamping portion 40a. Of course, the fastener 40d can be utilized in conjunction with a nut or the like.

[0021] As best seen in Figures 3, 4 and 16-18, the first clamping portion 40a forms a portion of a linkage assembly 50 that couples the mounting member 40 to the chain guide 42. In other words, portions of the linkage assembly 50 are integrally formed with the first clamping portion 40a as explained below.

[0022] The first clamping portion 40a has a curved portion 51, a pair of substantially parallel mounting flanges 52a and 52b that extend outwardly from the curved portion 51. Each of the mounting flanges 52a and 52b has a pivot hole 53a or 53b that receives a pivot pin 54a or 54b for coupling the second or outer link 46 thereto. The pivot holes 53a and 53b are axially aligned so that the second or outer link 46 pivots smoothly relative to the mounting member 40.

[0023] The first clamping portion 40a also has three additional threaded holes 55, 56 and 57 for fixedly securing three pivot axles 61, 62 and 63 for mounting the first or inner link 44 and the chain guide positioning mechanism 48 thereto, as explained below. The first threaded hole 55 fixedly receives a first or main pivot axle 61, which supports a part of the chain guide positioning mechanism 48.

[0024] The main axle 61 can basically be divided into four somewhat cylindrical sections 61a, 61b, 61c and 61d, as seen in Figures 19-20. Each of the end sections 61a and 61d of the main axle 61 is threaded with the first section 61a end being threadedly received in the hole 55 of the mounting member 40. The other or second end section 61d of the main axle 61 is threaded for receiving a nut 64 to hold a portion of the chain guide positioning mechanism 48. The second section 61b of the main axle 61 has the largest diameter and has a pair of flat sections so that the main axle 61 can be easily threaded into the hole 55 of the mounting member 40. This second section 61b forms an abutment surface with the third section 61c such that the chain guide positioning mechanism 48 is spaced from the mounting member 40. In other words, the second section 61b acts as a spacing section. The third section 61c of the main axle 61 has the positioning ratchet and the actuating member freely rotatable thereon. The end of the third section 61c remote from the second section 61b is preferably provided with a pair of flat sections for non-rotatably receiving the fixing plate during the installation procedure of the chain guide positioning mechanism 48. The main pivot axle 61 basically includes a first threaded section 61a, a second cylindrical section 61b with a pair of flat surfaces, a third cylindrical section 61c with a pair of flat surfaces and a fourth section 61d with threads.

[0025] The indexing axle 63 basically has three sections 63a, 63b and 63c, as best seen in Figures 23-25. The first section 63a of the indexing axle 63 is threaded for being threaded into the mounting hole 56 of the mounting member 40. The second section 63b of the indexing axle 63 has a pair of flat sections for rotating the indexing axle 63. This second section 63b also acts as a spacing element for aligning the indexing arm with the indexing cam. The third section 63c of the indexing axle 63 rotatably supports the indexing arm and has an annular groove for receiving a retaining clip for attaching the indexing arm thereto. The abutment surface formed between the second section 63b and the third section 63c has a plurality of axially extending holes that receive one end of the indexing spring. Preferably, the indexing spring is a torsion spring with one end located in one of the holes of the indexing axle 63, and the other end being bent around the indexing arm.

[0026] As best seen in Figures 2-15, the chain guide 42 is preferably constructed of a hard rigid material. For example, the chain guide 42 is preferably constructed of a metal material such as a rigid sheet metal that is bent to the desired shape. The chain guide 42 has a chain receiving slot that is formed by a pair of vertical shift plates 42a and 42b. The vertical shift plates 42a and 42b are adapted to engage the chain 20 and thus move the chain 20 in a direction substantially transverse to the bicycle 10. The shift plates 42a and 42b are connected together by a pair of plates 42c and 42d. The upper plate 42c is integrally formed between the shift plates 42a and 42b. The lower plate 42d has one end that is integrally formed with the outer shift plate 42b and the other end that is attached to the inner shift plate 42a via a fastener 65, such as a screw or rivet.

[0027] The chain guide 42 also has a pair of mounting flanges 42e and 42f extending outwardly from the inner shift plate 42a for coupling to the mounting member 40 via the inner and outer links 44 and 46. Thus, these mounting flanges 42e and 42f of the chain guide 42 form a portion of the linkage assembly 50 that couples the chain guide 42 to the mounting member 40. The mounting flange 42e is also preferably provided with a pair of threaded holes for receiving adjustment screws 66 and 67 therein. The first adjustment screw 66 is a low position adjustment screw, while the second adjustment screw 67 is a high position adjustment screw. The adjustment screws 66 and 67 engage a fan-shaped portion of the linkage assembly 50 for controlling a range of movement of the chain guide 42. In other words, by individually adjusting the axial extension of the adjustment screws 66 and 67 relative to the chain guide 42, the retracted (low position) and the extended (top position) of the chain guide 42 are independently adjusted relative to one another. This adjustment mechanism is well known in the art, and thus will not be shown or described in detail herein.

[0028] Preferably, the linkage assembly 50 is a four-

mounting the pawl 81 thereto via the pawl axle 82. The first hole 80a is sized and shaped to allow the actuating arm 80 to rotate freely about the main axle 61. The second hole 80b has the pawl axle 82 fixedly coupled therein. Preferably, the end of pawl axis 82 is deformed so as to be riveted to actuating arm 80. The actuating arm 80 is also provided with a through bore 80c located between the first and second holes 80a and 80b for receiving the shift cable 18 therein. Preferably, a curved groove 80d is formed from the through bore 80c around the first hole 80a for receiving the shift cable 18 as the actuating arm 80 is rotated. A surface groove 80e is also formed on the actuating arm 80 for receiving one end of the pawl spring 83.

[0037] The pawl 81 is rotatably mounted on the pawl axle 82, and includes an abutment or tooth 81a at the end that is remote from the hole 80b that receives the pawl axle 82. The pawl return spring 83 has its coiled portion located around the pawl axle 82 between the pawl 81 and the actuating arm 80. One end of the pawl return spring 83 engages the pawl 81, while the other end of the pawl return spring 83 engages the actuating arm 80 to bias the pawl 81 against the peripheral surface of the positioning ratchet 70. Specifically, the other end of the pawl spring is engaged in the surface groove 80e of the actuating arm 80. Accordingly, the pawl 81 engages the teeth 70a of the positioning ratchet 70 to rotate the positioning ratchet 70 when the actuating arm 80 is rotated in a counterclockwise direction, as seen in Figures 3-15. However, when the actuating arm 80 is rotated in a clockwise direction, the pawl 81 engages the ramping surfaces 70c of the teeth 70a so that the actuating arm 80 can rotate relative to the positioning ratchet 70. In other words, rotation of the actuating arm 80 in the clockwise direction does not cause the actuating cam 71 or the indexing cam 72 to move. The actuating arm 80 is rotated in the counterclockwise direction when the shift lever 32 is squeezed to cause the shift cable 18 to pull the actuating arm 80. The actuating arm 80 is rotated in the clockwise direction when the shift lever 32 is released to slacken the shift cable 18. The rotation in the clockwise direction of the actuating arm 80 is produced by the force of the actuating return spring 85. The rotation of the actuating arm 80 in the clockwise direction will stop when the shift cable 18 becomes taut. Alternatively, rotation of the actuating arm 80 in the clockwise direction will stop when the actuating arm hits a stopper 84c that extends from the return spring fixing plate 84.

[0038] The pawl axle 82 is a step-shaped shaft having a first end 82a that is received in the actuating arm 80, a center spacing section 82b with the largest diameter, a spring support section 82c, and a pawl supporting section 82d. The pawl supporting section 82d has an annular groove for receiving a C clip to retain the pawl thereon. First end 82a of pawl axle 82 is preferably deformed to be riveted to actuating arm 80. Alternatively, first end 82a of pawl axle 82 could be threadedly coupled to actuating arm 80. Accordingly, the pawl is mounted for rotation on the pawl supporting section 82d section.

[0039] Turning now to Figures 4 and 38, the fixing plate 84 has a non-circular center hole 84a that receives a portion of the main axle 61 so that the fixing plate 84 does not rotate relative to the main axle 61. The fixing plate 84 also has a plurality of spring adjustment holes 84b that are located in an arc-shaped pattern about the center of the fixing plate 84. These holes 84b receive one end of the actuating return spring 85, while the other end of the actuating return spring 85 engages a portion of the actuating arm 80. Preferably, the actuating return spring 85 is a torsion spring. The fixing plate 84 is preferably provided with a stopper 84c to limit the clockwise rotation of actuating arm 80. Alternatively, stopper 84c can be eliminated if needed and/or desired. In such an arrangement, cable 18 and actuating member return spring 85 should be configured to provide the function of a rotational stop for actuating arm 80.

[0040] Turning now to Figures 3, 4, 23-25 and 41-44 the indexing member or mechanism 74 basically includes an indexing arm or element 90 and an indexing spring 91. The indexing arm 90 is a somewhat L-shaped member with one end being pivotally mounted on the indexing axle 63. The other end of the indexing arm 90 is a free end 90a designed to slide along indexing cam 72. Alternatively, free end 90a can have an indexing roller rotatably mounted thereto if needed and/or desired. The indexing spring 91 is mounted on the indexing axle 63 for biasing the indexing arm 90 against the indexing cam 72 such that the free end 90a of the indexing arm 90 engages the outer peripheral surface of the indexing cam 72. As the indexing cam 72 rotates in a clockwise direction, the camming protrusions 72a-72d of the indexing cam 72 causes the indexing arm 90 to rotate in a clockwise direction around the indexing axle 63 against the force of the indexing spring 91. Preferably, the indexing spring 91 is a torsion spring with one end coupled to the indexing axle 63 and the other end engaging the indexing arm 90. When the free end 90a of the indexing arm 90 is located in one of the recesses 72e-72h between the camming protrusions 72a-72d of the indexing cam 72, rotation of the positioning ratchet 70 and the actuating cam 71 is overridably maintained. In other words, the positioning ratchet 70 and actuating cam 71 will not rotate until pawl 81 and actuating arm 80 rotate in the counter clockwise direction. During such rotation, the force applied from actuating arm 80 is larger than the force of indexing spring 91.

[0041] Referring to Figures 4 and 29, the cam follower 75 basically includes a cam follower axle 95 and a cam follower roller 96 that is rotatably mounted on the cam follower axle 95. The cam follower axle 95 is fixedly secured to the inner link 44 such that the cam follower roller 96 is located within the actuating groove 78 formed in the positioning ratchet 70. Specifically, cam follower axle 95 is secured in hole 44c of inner link 44. As the positioning ratchet 70 is rotated, the peripheral surface of

Claims

1. A bicycle derailleur (12), comprising:

   a mounting member (40) that is adapted to be coupled to a portion of the bicycle (10);
   a chain guide (42) movably coupled to said mounting member (40), said chain guide (42) being adapted to shift a chain (20) of a bicycle (10) in a transverse direction; and
   a chain guide positioning mechanism (48) including an actuating cam (71) operatively coupled to said chain guide (42), said actuating cam (71) being adapted to be coupled to a control element (18) and arranged to rotate only in one direction in response to movement of the control element (18) to move said chain guide (42) from a first position to a second position.

2. A bicycle derailleur (12) according to claim 1, wherein
   said chain guide (42) is movably coupled to said mounting member (40) by a linkage assembly (50), which is moved by rotation of said actuating cam (71).

3. A bicycle derailleur (12) according to claim 2, wherein
   said linkage assembly (50) includes a pair of links (44, 46) pivotally coupled at first ends to said mounting member (40) and pivotally coupled at second ends to said chain guide (42).

4. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said actuating cam (71) contacts one of said links (44, 46) to cause pivotal movement thereof.

5. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said chain guide positioning mechanism (48) includes a one-way clutch mechanism coupled to said actuating cam (71).

6. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said one-way clutch mechanism includes a ratchet (70) fixedly coupled to said actuating cam (71) and an actuating element (80) with a pawl (81) engaging said ratchet (70), said actuating element (80) having a control element attachment structure that is adapted to be coupled to the control element (18).

7. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said actuating element (80) is pivotally coupled on a first axle (61).

8. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said ratchet (70) and said actuating cam (71) are pivotally coupled on said first axle (61).

9. A bicycle derailleur (12) according to any of the preceding claims, wherein
   said chain guide positioning mechanism (48) includes an indexing mechanism (74) with an indexing element (90) that is arranged to operatively apply a retaining force to said actuating cam (71).

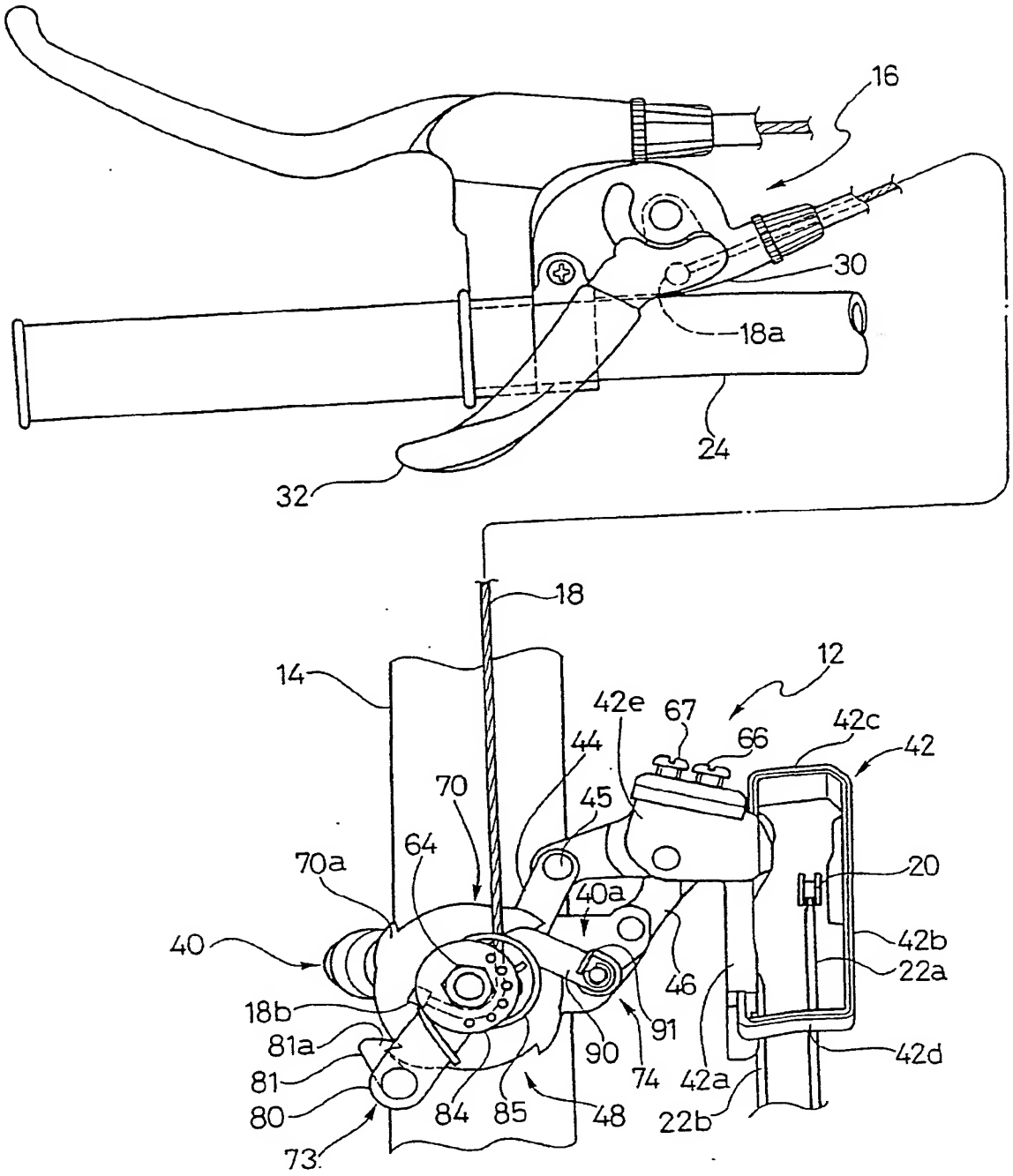
10. A bicycle derailleur (12) according to any of the preceding claims, wherein
    said indexing mechanism (74) further includes an indexing cam (72) that is fixedly coupled to said actuating cam (71) to rotate therewith and said indexing element (90) contacts said indexing cam (72) to apply said retaining force to said actuating cam (71).

11. A bicycle derailleur (12) according to any of the preceding claims, wherein
    said indexing element (90) is pivotally mounted to said mounting member (40) and biased against said indexing cam (72) to apply said retaining force thereto.

12. A bicycle derailleur (12) according to any of the preceding claims, wherein
    said actuating cam (71) includes an annular actuating groove (78) with a cam follower (75) located therein, said cam follower (75) being coupled to said linkage assembly (50).

13. A bicycle derailleur (12) according to any of the preceding claims, wherein
    said actuating groove (78) is oval shaped with two points corresponding to said first position and two points corresponding to said second position such that one rotation of said actuating cam (71) cause said chain guide (42) to reciprocate twice between said first and second positions.

14. A bicycle derailleur (12) according to any of the preceding claims, wherein
    said chain guide (42) is arranged above said mounting member (40).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42e
67
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42c
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40a
40
42b
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74
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FIG. 2

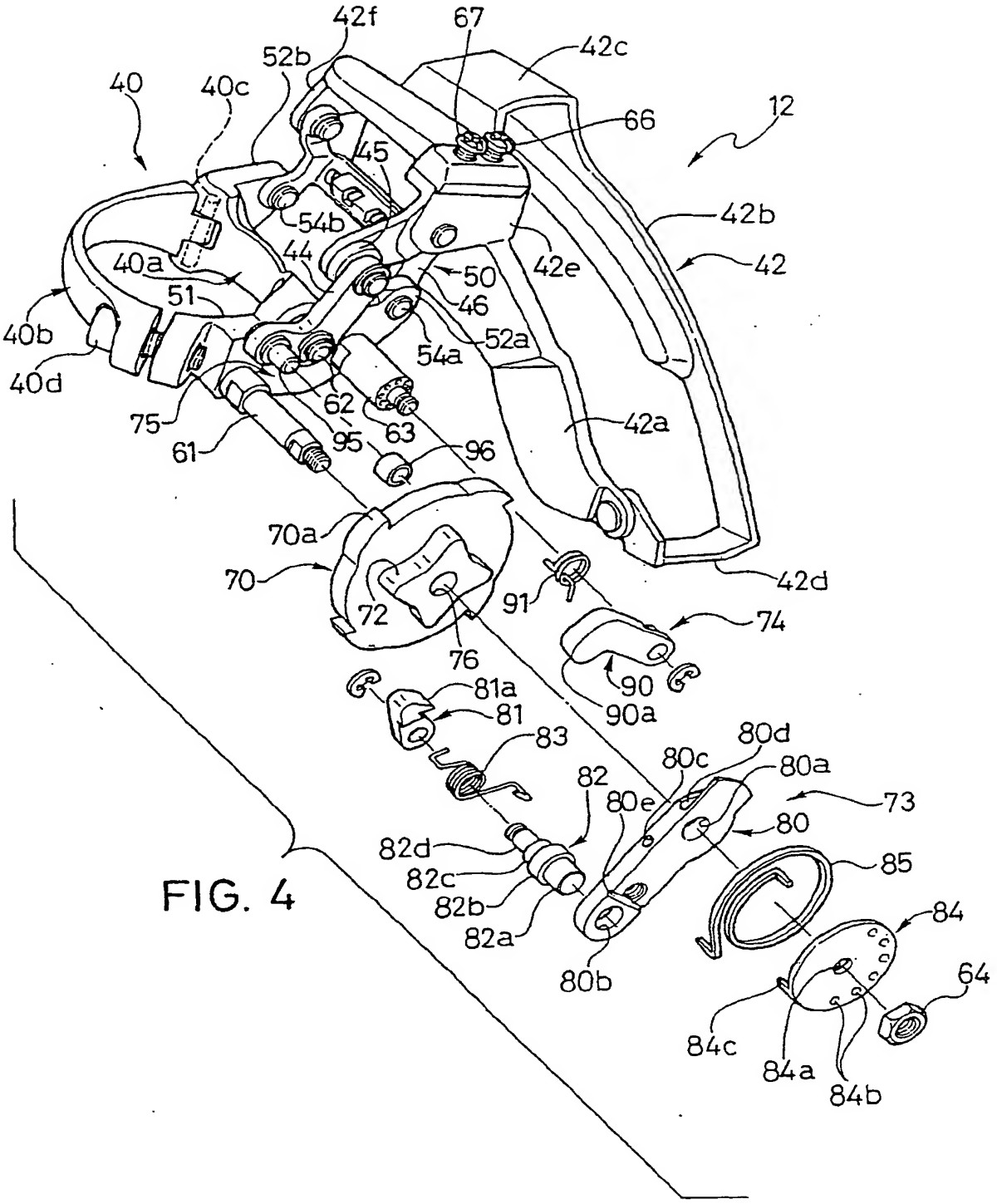
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FIG. 4

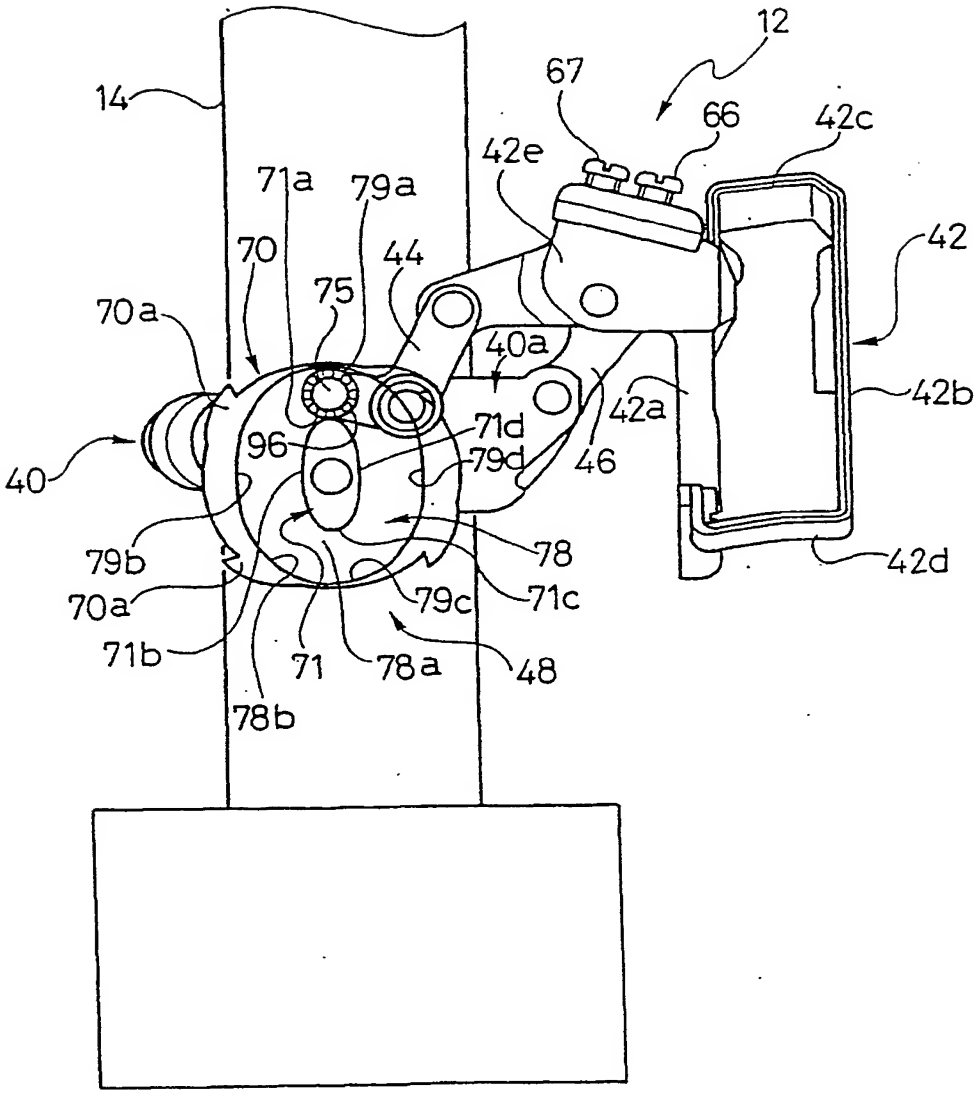
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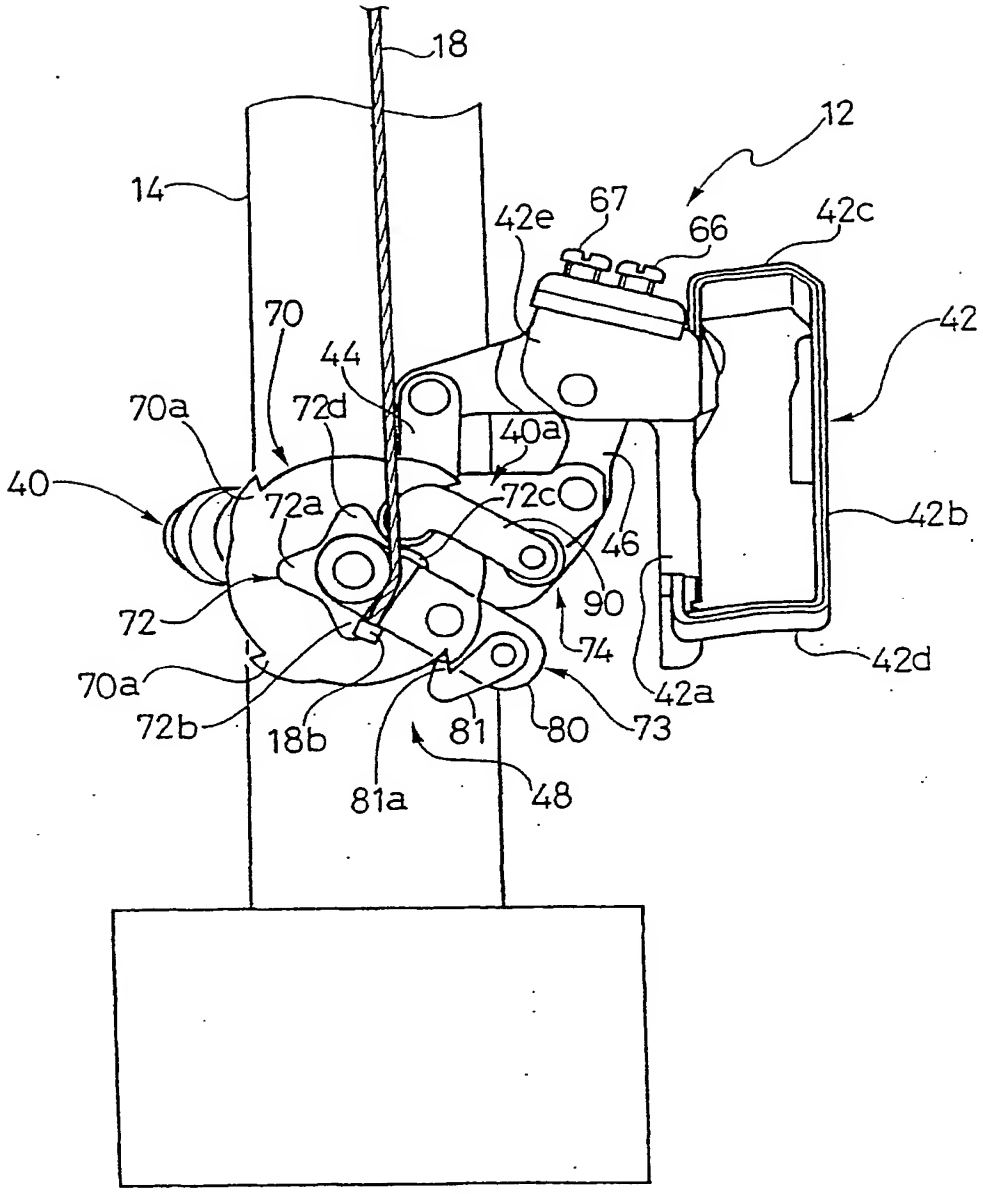
FIG. 6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74
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FIG. 8

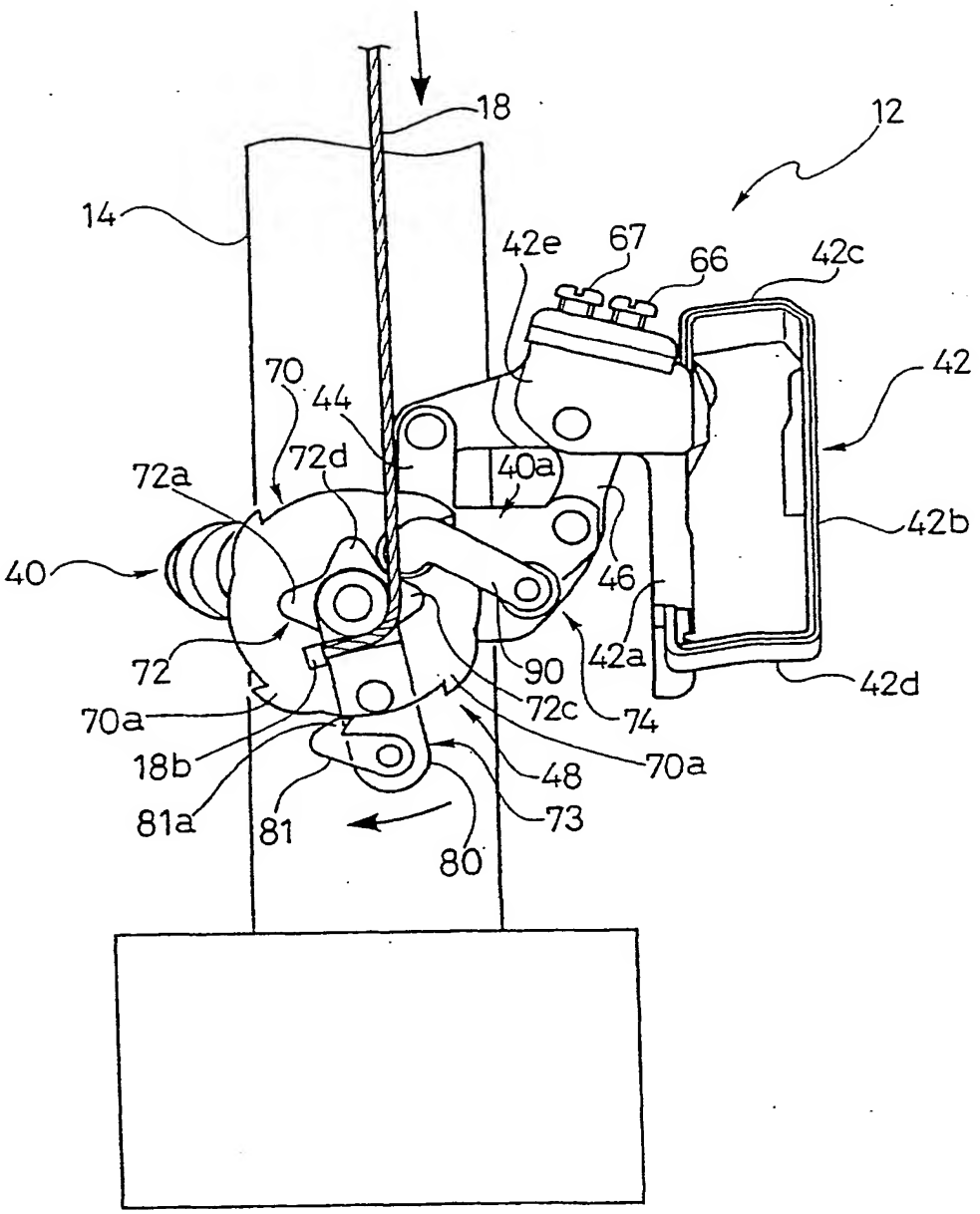
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FIG. 10

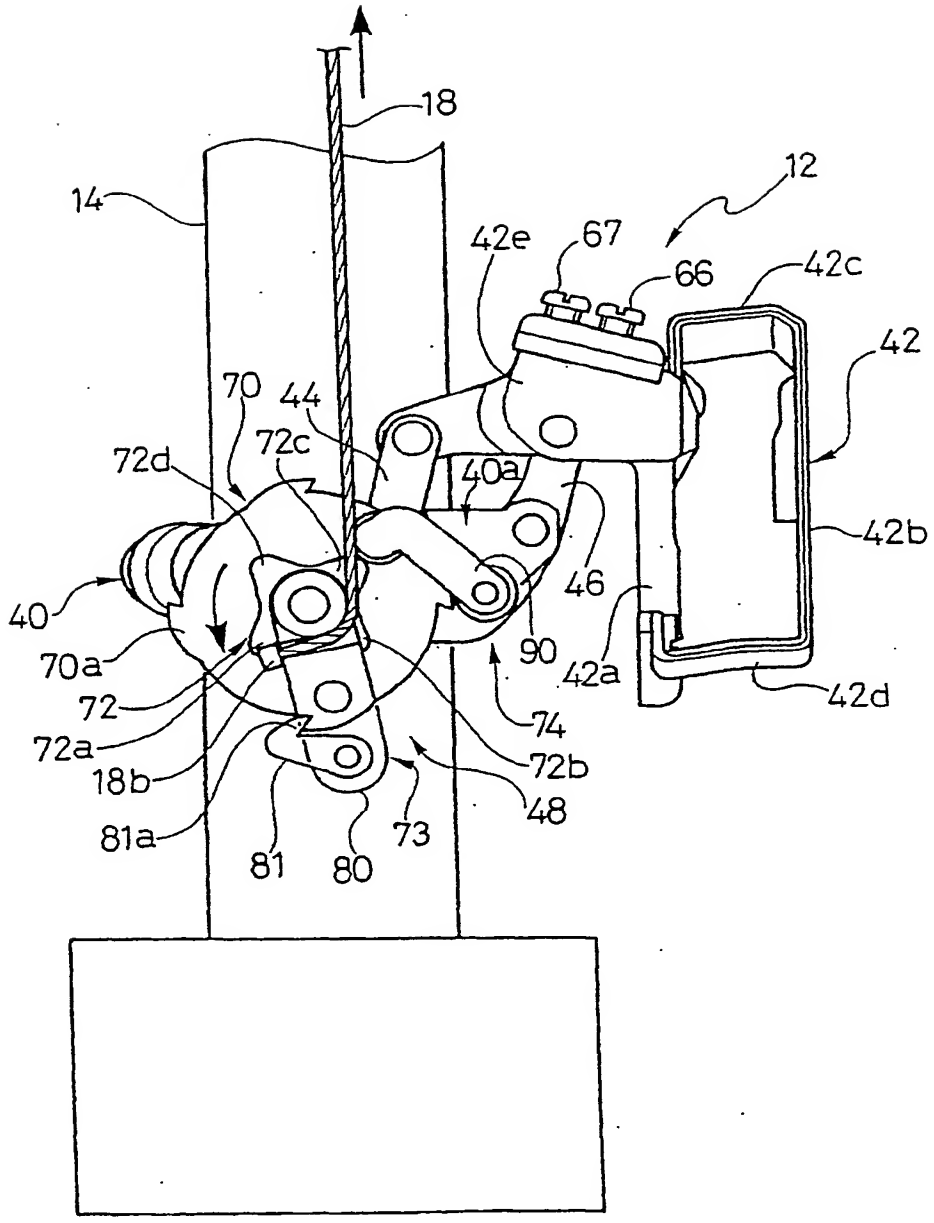
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FIG. 12

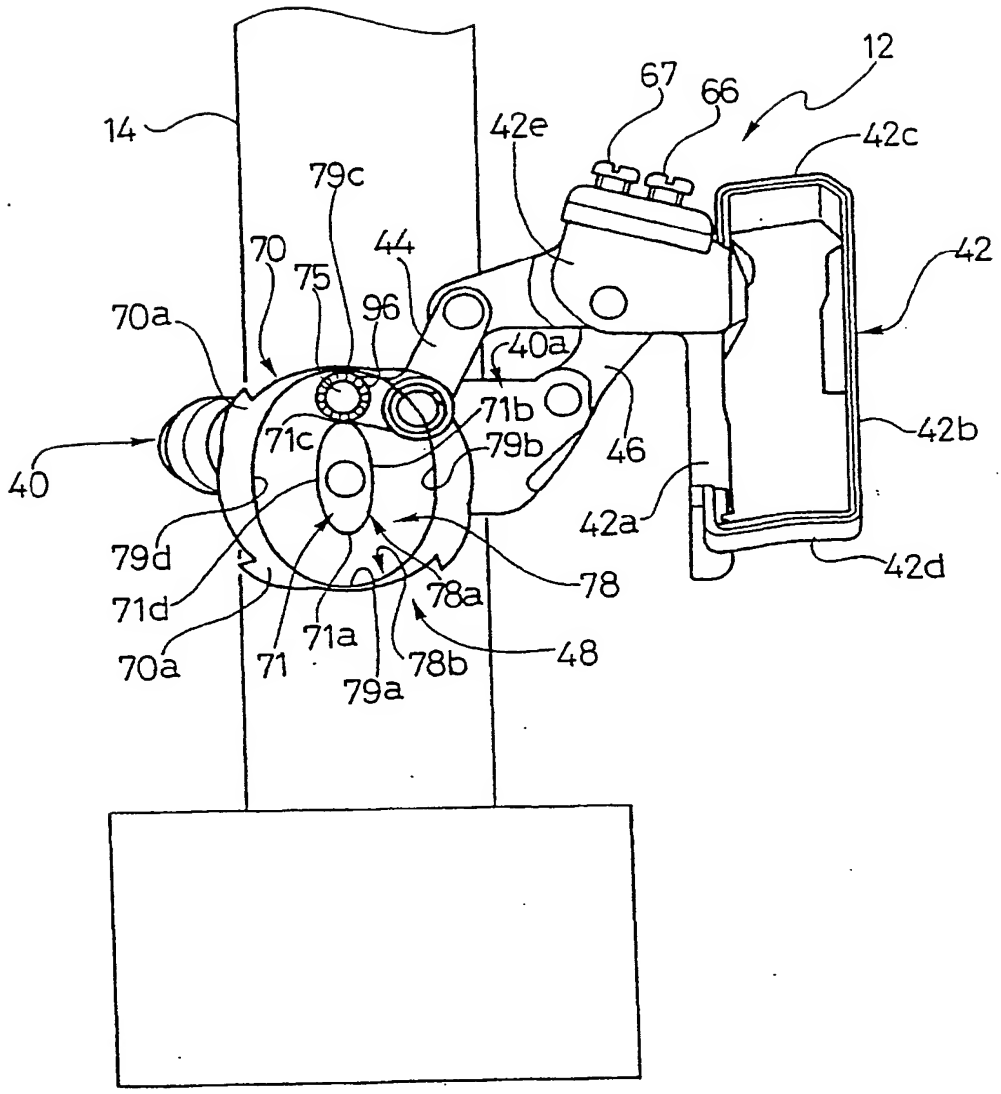
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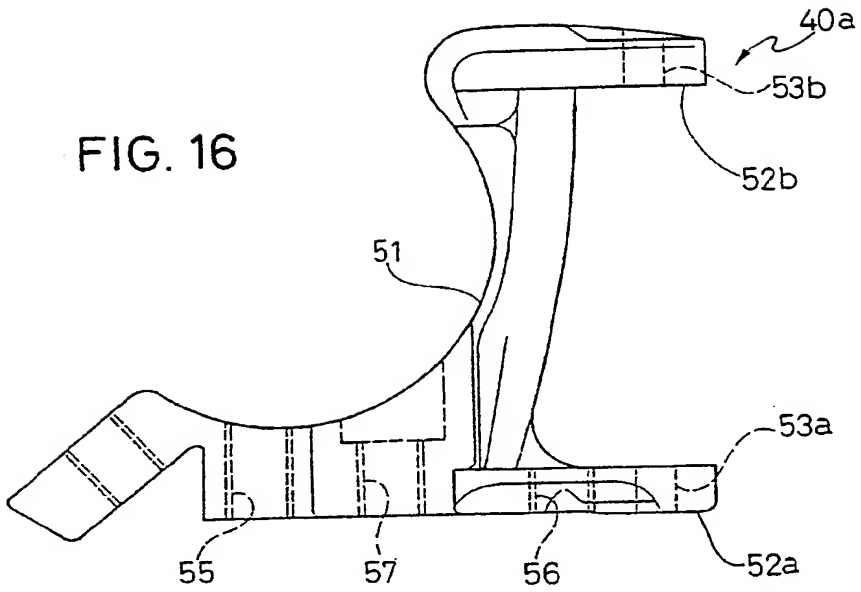
FIG. 14

FIG. 16



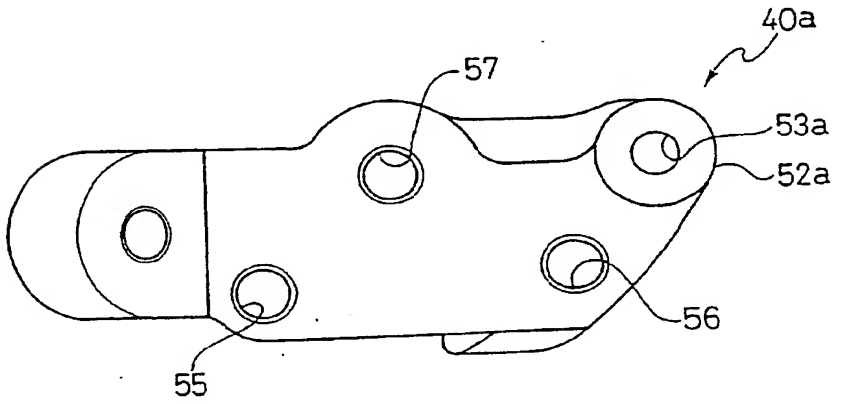


FIG. 17

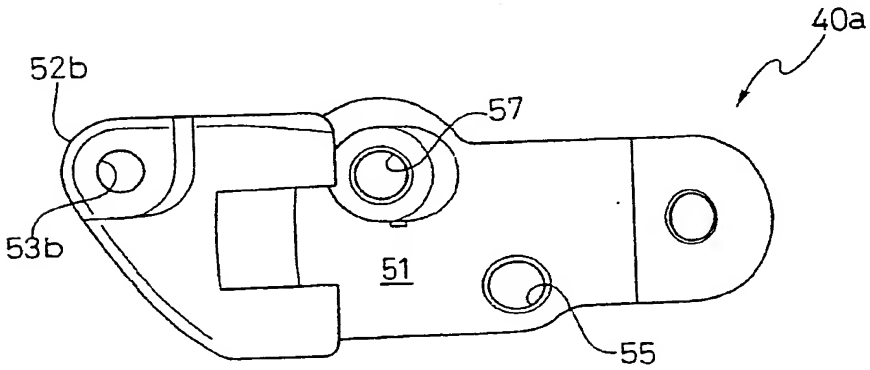


FIG. 18

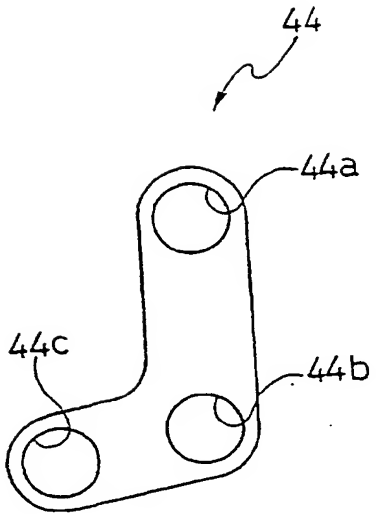


FIG. 26

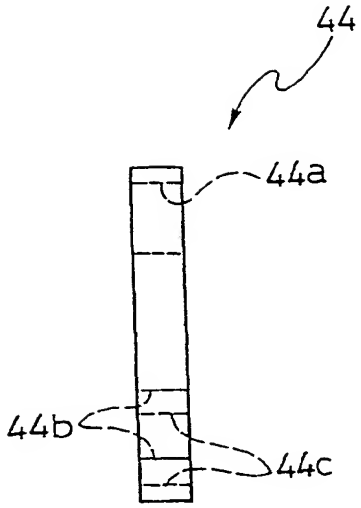


FIG. 27

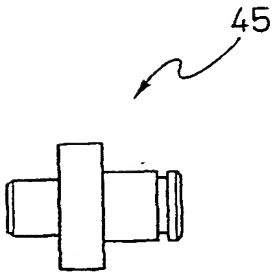


FIG. 28

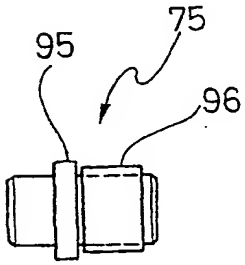


FIG. 29

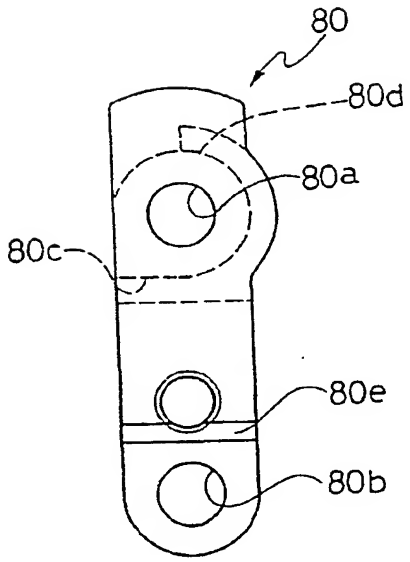


FIG. 34

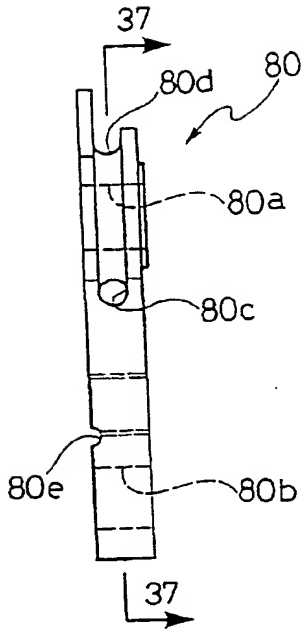


FIG. 35

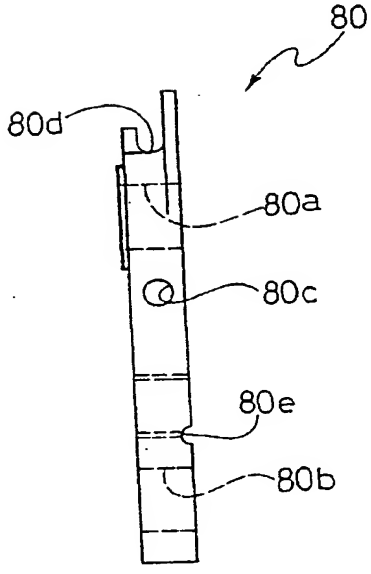


FIG. 36

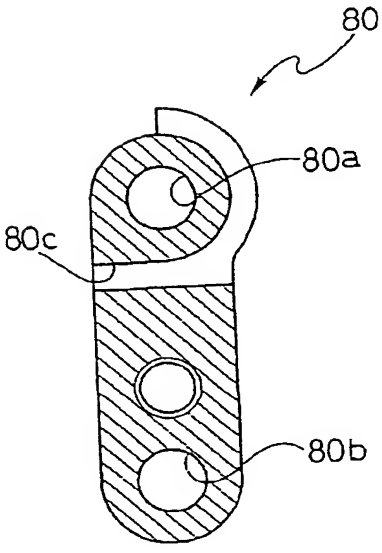


FIG. 37

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 147 978 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
31.03.2004 Bulletin 2004/14

(43) Date of publication A2:
24.10.2001 Bulletin 2001/43

(21) Application number: **01108859.8**

(22) Date of filing: **09.04.2001**

(51) Int Cl.[7]: **B62M 9/12**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **17.04.2000 US 550712**

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(54) Bicycle derailleur

(57) A derailleur 12 for a bicycle 10 is provided that is easy to operate. The derailleur 12 basically has a mounting member 40, a chain guide 42 and a chain guide positioning mechanism 48. The mounting member 40 is adapted to be coupled to a portion of the bicycle 10. The chain guide 42 is movably coupled to the mounting member 40. The chain guide 42 is adapted to shift a chain 20 of a bicycle 10 in a transverse direction. The chain guide positioning mechanism 48 has an actuating cam 71 operatively coupled to the chain guide 42. The actuating cam 71 is adapted to be coupled to a control element 18 such as a cable. The actuating cam 71 is arranged to rotate only in one direction in response to movement of the control element 18 to move the chain guide 42 from a first position to a second position. In the preferred embodiment, the chain guide positioning mechanism 48 includes one-way clutch coupled to the actuating cam 71, and an indexing mechanism 74 with an indexing element 90 that is arranged to operatively apply a retaining force to the actuating cam 71. The one-way clutch has a ratchet 70 fixedly coupled to the actuating cam 71 and an actuating element 80 with a pawl 81 engaging the ratchet 70. The actuating element 80 is adapted to be coupled to the control element 18 such that the control element 18 rotates the actuating element 80, which in turn engages the ratchet 70 to rotate the actuating cam 71 and moves the chain guide 42.

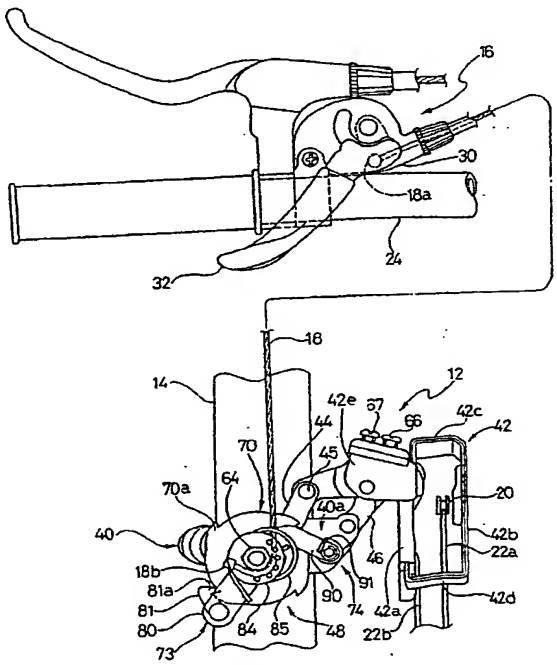

FIG. 2

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 10 8859

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